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DATE: Oct. 6, 1988	NUMBER OF PAGES: 13 (Includes this cover sheet)
TO: Sharon Feldstein EPA Region III 841 Chestnut Building 3HW16 Philadelphia PA 19107	RECEIVING STATION Phone Number: 215-597 0531 7906 Fax Telephone #: 215-597-9800
FROM: Chris CARLSON Lockheed 1050 E. Flamingo Blvd Suite 124 Las Vegas, NV 89109	SENDING STATION Phone Number: 215-734-3758 FAX: 702-796-1084
SUBJECT: Maryland Sand & Gravel Site RI	

REMARKS/SPECIAL INSTRUCTIONS:
attn: Sharon Feldstein

302530

Maryland Sand, Gravel, and Stone (MSGS) Site Comments on Chemical Results of the Phase II Report

Jeff Rosenfeld
Biochemist

(1) The presence of toluene in 10 of the 11 Lower Sand and Bedrock (deeper aquifers) monitoring wells suggests that vertical migration is occurring between the contaminated Upper Sand aquifer and the deeper aquifers. Toluene is one of the volatile organic compounds (VOCs) detected in the Upper Sand monitoring wells that have been drilled near the Eastern Excavated Area disposal ponds. Its presence in the deeper aquifers contradicts the statement in the Phase II Report (p. 5-14) that the ground water elsewhere on the site is "essentially clean". The toluene concentrations in the Upper Sand range from 150 to 29,000 mg/L, and the concentrations in the deeper aquifers range from 6 to 120 ug/L.

The chemical results raise three questions:

1. Why is toluene the only VOC detected in the deeper aquifers (except for methylene chloride and acetone, which are probable lab contaminants)?

2. How do you reconcile the presence of toluene in the deeper wells with the extremely long travel times calculated from the slug test hydraulic conductivities?

3. Why is toluene present in the Upper Sand and deeper aquifers, but not the Middle Sand?

These three questions suggest that the hydrology and contaminant transport at the site requires further study.

A large number of VOCs were detected in the Upper Sand wells near the disposal ponds (for example, 21 VOCs were detected in the sample from well SMW-01), yet toluene is generally the only VOC detected in the deeper aquifers. One possible explanation is that toluene is a widespread contaminant in the area and is not necessarily related only to the MSGS site. This explanation, however is not well supported, because toluene was not detected in the upper aquifer, off-site wells. Another possibility is that toluene was dumped first at the site and has had the time to migrate vertically to the deeper aquifers and horizontally to the downgradient wells, and that the other contaminants in the Upper Sand wells were dumped at a later time. If only toluene was not dumped first and if the disposal ponds are the source of the toluene, then several of the other VOCs with similar solubility and partition coefficients should also be present in the downgradient wells. It would be interesting to know if toluene was detected in the off-site, downgradient wells (MW-1,2,3) sampled during Phase I.

If the disposal ponds are the source of the toluene, then the calculated travel times presented in Table 5-12 appear to be too long. Six of the deeper aquifer

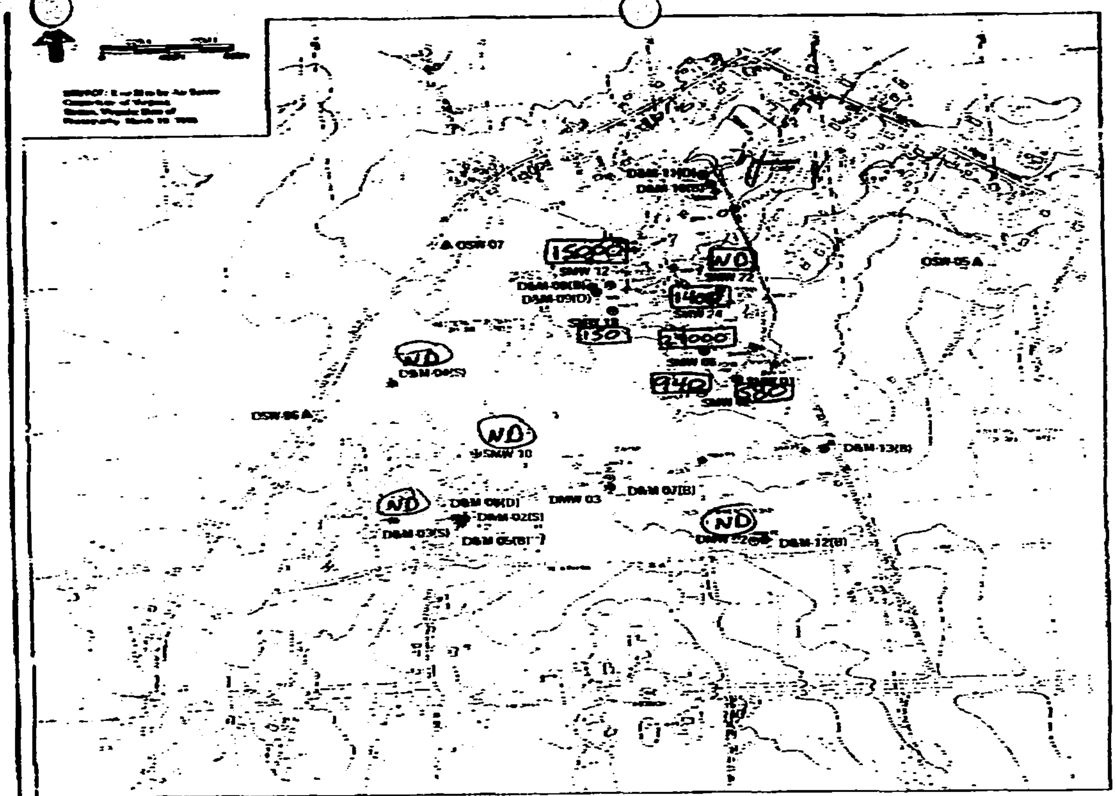
wells in which toluene was detected are near the southern boundary of MSGS, downgradient of the disposal ponds. The presence of toluene in these wells would require travel times similar to those calculated for the fractured bedrock in well D&M-07 (4.8 years from Pond 3 to D&M-07). If the other calculated travel times are correct, then there must be another source or migration pathway for the toluene.

The migration pathway for the toluene is also uncertain, because toluene has not been detected in any of the Middle Sand wells. Therefore, the suggested migration pathway from the contaminated Upper Sands to the deeper aquifer via surface seeps, recharge of the Middle Sands, and leakage through gaps in the confining units is not probable.

Analytical results from two of the Lower Sand montoring wells (D&M-06 and -09) suggest either (1) poor quality sampling or measurements or (2) the presence of additional types of contamination at the site. These samples had much higher field pH (12) and specific conductance (4,000 umhos/cm) values than the other ground-water samples collected during Phase II. The laboratory results also showed that these samples generally had higher calcium, potassium, sodium, barium, lead, aluminum, and chromium concentrations. The wells should be resampled, and, if the results are found to be consistent, additional characterization of the area between the wells may be necessary.

The VOC detection limits for some of the Upper Sand sample are very high relative to the Contract Lab Program Required Quantification Limits. Although the VOC concentrations that were reported are evidence that these samples are obviously quite contaminated, the detection limits for some of the individual compounds that were reported to be not detected are meaningless in terms of drinking-water quality criteria. Better detection limits should be required for future analyses of these samples.

The high concentrations of several VOCs in the Upper Sand wells near the disposal ponds, the presence of only toluene in the deeper aquifers, the high field pH and specific conductance values in two Lower Sand wells, and the lack of contamination in the Middle Sand wells all suggest that the contaminant migration pathways at the MSGS site are not totally understood. Because the complex hydrogeology at the site may preclude total understanding, one approach would be to assume that the presence of toluene in the deeper aquifers suggests that vertical migration of contamination is occurring at the site. Therefore, remediation of the contaminated shallow ground water and soil near the disposal ponds should be started to remove the source for potential deeper ground-water contamination, while the monitoring of the deeper aquifers is continued. In this way, it should be possible to detect the potentially toxic VOCs (other than toluene) which are present in the Upper Sand aquifer, as soon as they reach the deeper aquifers, but before they can migrate off site and affect the nearby drinking-water supply.



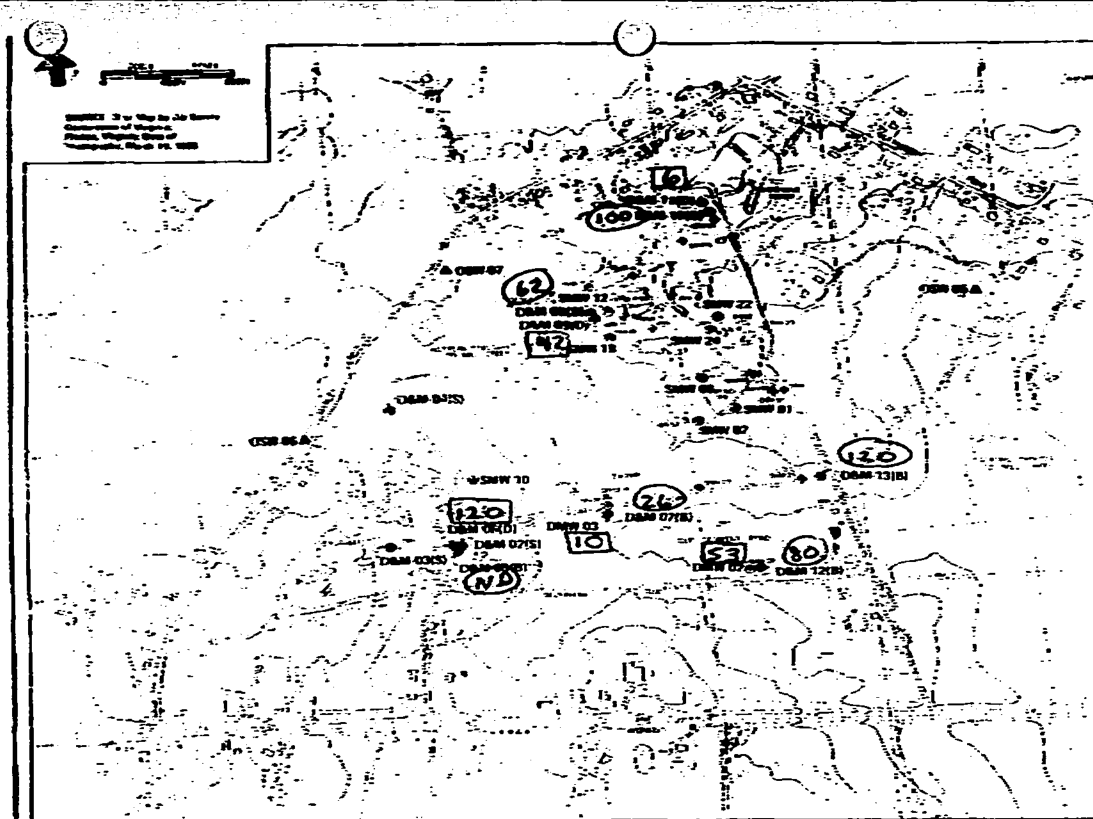
LEGEND

Upper Sand □

Middle Sand ○

TOLUENE CONCENTRATI-
(μg/L)

FIGURE 5-1
LOCATION OF ON SITE
MONITORING WELLS AND
RESIDENTIAL WELLS SAMPLED
NEAR THE SITE



LEGEND

Lower Sand □

Bedrock ○

TOLUENE CONCENTRATION
(µg/L)

FIGURE 5-1
LOCATION OF ON SITE
MONITORING WELLS AND
RESIDENTIAL WELLS SAMPLED
NEAR THE SITE

Review of Maryland Sand and Gravel Site

By Christian L. Carlsen Hydrogeologist

In reviewing the report on the Maryland Sand and Gravel Site, several comments and questions arise.

Flow rates calculated from data collected during the slug tests on the different aquifers are within reason. Hydraulic conductivity values, however seem very slow for sand and gravel. Hydraulic conductivity for the upper sand and gravel unit was reported to be E-4 cm/sec to E-5 cm/sec. The USGS values for sand and gravel to coarse sands range from E-2 cm/sec to 1.16 cm/sec, and C.W.Fetter reports values ranging from E-2 cm/sec to 1 cm/sec. The accuracy of the values give by the authors seems suspect, and further characterization may be necessary.

The discussion on the well survey, page 5-3, does not state screen intervals or well depths but gives an average pump rate of 15.9 GPM. How was this rate derived? Some of the rates for these wells are quite high compared to the rates measured on site, yet the on-site and off-site measurements apparently are from the same sedimentary sequence. Further investigation of the MSGS area wells may be necessary.

High pH values at four of the wells indicate a possible well-construction problem. The pH values for these wells is approximately 12; the surrounding wells have a pH range between 4 and 7. In addition, the high pH values are not all from the same screen interval. Is grout contamination a possibility?

The authors report lacks detail on site geology, fracture patterns, and fracture orientation in the bedrock. The stratigraphic columns in the cross sections show small clay lenses around the wells themselves; some of these lenses could be connected or excluded. The geophysical logs should help clarify the site geology, but these logs also are hard to interpret. The borehole logs appear to have been run through the grout and filter pack. Would the bentonite affect the gamma or the neutron logs, and therefore, their interpretation? The authors state

that the geophysical logs support the evidence from drill cuttings, but I believe there is some discrepancy in the lithologic correlation (e.g., D&M-07).

Hydraulic conductivity tests were preform on undisturbed samples; applying the results to the vertical component of ground-water movement is a little weak. How can we be assured that the sample was undisturbed, and on what basis can we apply this data to the vertical ground-water movement at the site? The conductivity value given is quite slow, approximately E-7 cm/sec, yet toluene has been detected in the deep wells. Is it possible that there were two contamination events? The authors state that there is not any off site contamination but toluene is at the southeast border. There are no reports of sampling at the RW wells just south of the site. Bedrock wells in the up gradient and down gradient areas off-site may need to be installed to varify their claim that not off-site migration has occured.

The alluvial deposits are reported by the author as a fining sequence, which is usually associated with meandering or braided rivers. Usually, in this type of alluvial environment, the sand and gravel are well sorted, are clean, and have short lateral extent. The authors describe the middle sand unit as having a hydraulic conductivity of E-5 cm/sec; the USGS and C.W.Fetter report values of E-3 cm/sec to E-1 cm/sec. The E-5 cm/sec value reported seems suspect. In reviewing off-site wells that are completed from 90 ft to 110 ft, the pump rates average 16 GPM and the draw down average approximately 10 feet. This data suggest a much faster rate than the authors report for the site.

The data on ground-water velocities predict arrival time between 239 and 11 million years, yet toluene is already at the southeast site boundary. These velocities are calculated from flow rates, hydraulic conductivity values, and pump-test rates which are much slower than those of off-site wells. The validity of the estimated rates seem suspect and supports further well-construction examination.

The screening, filter pack material, and height of bentonite cap on the existing on-site wells raise some questions about

their construction. The reports indicates that the filter pack on well D&M-04 is composed of gravel, with the bentonite cap 10 feet above the top of the screen. This well crosses two sand layers with a clayey silt layer between them. Well D&M-5 has a bentonite cap 14 feet above the screen and #20-30 sand pack. This well and well D&M-10 cross the weathered bedrock, saprolite, and the bedrock. These descriptions of well construction make analysis difficult. In addition, there is little said about previous wells on the site.

If you have any questions about the site or these comments, fell free to call Russ Plumb, Jeff Rosenfeld, or Chris Carlsen at (702) 734-3258.

DATE SEPTEMBER 2, 1988

TO P. A. MALLEY DEPT./ ORGN. 81-02 BLDG./ ZONE FRP PLANT/ FAC. K-01

FROM R. H. PLUMB DEPT./ ORGN. 83-02 BLDG./ ZONE FRP PLANT/ FAC. K-01 EXT. 3207

R. H. Plumb

SUBJECT: REVIEW OF MARYLAND, SAND, GRAVEL, AND STONE PHASE II REPORT

I have had an opportunity to review the subject report. I believe the observed toluene distribution at the site is the result of two or more release or leakage events. However, in order to verify this, it will be necessary to carefully review the data as a function of depth, sampling location, and stratigraphy.

I believe there are several aspects of the report that are weak. First, there are no anion results which tends to reduce the usability of the inorganic data. Second, although samples were analyzed in the field and two laboratories, there was no discussion of how the individual data sets compared. Third, the discussion of water quality problems was incomplete. Finally, portions of the technical discussion appeared to be superficial.

I have attached a set of general comments and a set of specific comments that were generated during the document review. Should you have any questions, please feel free to contact me at your convenience.

302538

GENERAL COMMENTS ON THE MARYLAND SAND, GRAVEL, AND STONE SITE

I have several concerns regarding the quality of the ground water data in the subject report. First, I don't believe it is stated whether the results are "dissolved" or "total" results. Although the issue has never been standardized, samples analyzed for "total" concentrations are subject to contamination from particles sloughing off the well walls or aquifer. This can contribute to data variability that is not representative of the system being monitored. Second, the data set would be more helpful if the samples had been also analyzed for the major anions. This would permit anion-cation balances and sum of ion calculations to be performed. The anion data would also permit individual aquifers to be "finger-printed" to determine whether aquifers are inter-connected. Third, using a conservative assumption that all anions are bicarbonate, a sum of ions calculations were performed with the data from several wells. The ratio of estimated sum of ions/specific conductivity varied from 0.38 to 1.23 and did not approach a constant value as would be expected.

A plot of toluene concentration as a function of sampling location suggests very high concentrations (1400-2900 µg/L) in the near-surface wells in the vicinity of the eastern excavated area. Toluene concentrations decreased by two orders of magnitude in the southerly on-site wells and below the limit of detection in all adjacent residential wells (Figure 1). This creates a preliminary impression that a leakage event had occurred and the contaminants are migrating in a southerly direction but had not yet migrated off-site. However, when the toluene data is plotted as a percentage of detected organic contaminants (toluene concentration x100/sum of detected volatile organic compounds), a modified scenario is suggested (Figure 2). The high toluene concentrations in the near surface wells (SMW-12, SMW-24, SMW-06) represent 37 to 56 percent of the detected volatile organic contamination. However, in the deeper surface wells, toluene represents 87 to 100 percent of the detected volatile organic contamination. If the toluene was migrating from the same source, the concentration of toluene would decrease with distance but the proportion of toluene shouldn't change so drastically. I am not aware of any phenomena that would account for 100 percent degradation and/or retardation of the migration of benzene and chlorobenzene while permitting toluene (another benzene derivative) to migrate through the system. Therefore, I believe the toluene data represent two events. This is further substantiated by the fact that all the high percentage toluene occurrences are in the deeper wells and the smaller percentage toluene occurrences are in the shallow wells.

1. If the data represent at least two different spill or leakage events, it would be inappropriate to use the data interchangeably in modeling exercises.

2. If two events occurred, the interconnection between aquifers may be much lower than anticipated.

3. The conclusion that contaminants are not moving off site may be tenuous. The off-site residential wells show no toluene. However, since all the deeper on-site wells are contaminated with toluene, the conclusion should be reevaluated based on the depths of the off-site wells. (If the off-site wells are shallow, the contamination could be migrating beneath the screened level).

The report stated that only one cadmium result from one well exceeded water quality criteria. However, over half the manganese results exceed the water quality criterion of 50 µg/L. This may not be critical because manganese is easily removed and the criterion is based on aesthetic effects rather than health effects - but they are water quality problems that were not discussed. Also, many iron results also exceed the water quality criterion of 300 µg/L.

Many results from well D&M-06 show elevated concentrations - pH, conductivity, sodium, potassium, calcium, and magnesium. There is not enough information to determine whether these results are an artifact of well construction or represent the on-set of a leakage event.

PS1 ¶ 1, Line 8:	Has the waste been characterized?
PS1 ¶ 2, Line 7:	What compounds?
PS1 ¶ 2, Line 9:	What compounds?
PS5 ¶ 2:	What is considered a "significant metal concentration"?
P2.2 ¶ 2, Line 1:	6191 acres is only 0.27 percent of the country land area.
P2.2 ¶ 2, Line 5:	7 percent should be 0.7 percent.
P3.1:	Section titled "Waste Information" really doesn't provide information on waste materials disposed at the site.
P4.4 ¶ 4:	Were all the composited cores from the same depth? Was the mass of material to be composited measured?
P4.4 ¶ 4:	Was the presence of sassafras and pine aromas verified with laboratory analyses?
Table 4.2 & Table 4.3:	The two sets of data should have been compared to evaluate laboratory performance.
Section 5.1.2 and 5.1.3	These sections are so generic as to be almost useless. While they provide some information on the range of conditions to be encountered, they provide no information on trends or specific locations.
P5.5 ¶ 2, Lines 5 through 6:	Six wells is a dense network?
P5.5 ¶ 2 Line 6:	How was representativeness assessed?
P5.11 ¶ 4:	Why wasn't D&M02 included in Figure 5.7?
P5.11 ¶ 4:	There are no well logs for D&M02 in Appendix D.

P5.7 ¶ 4, Line 4: If silt/clay layer is absent from D&M-10, why is it indicated as being present in Figure 5-11?

P5-10: According to Figure 5.1, wells SMW-12 and SMW-18 are near Pond 03 and wells SMW-22 and SMW-24 are near Pond 02. Text is incorrect.

P5.13 ¶ 1: How does the fact that toluene has been detected at D&M-07 corroborate the velocity calculations?

The ground water velocity calculations should have been placed in with Groundwater Flow (Section 5.2.2) and not Groundwater Quality (Section 5.3).

P5.23-P5.33: Target Compound List MCL's should be listed. Also, the screened interval for each well should be listed.

There was no attempt to describe/discuss the spatial distribution of ground-water contaminants.

P7.2 Bottom: Indicator scores <u>based</u> on....

P7.3 ¶ 3: There is no need for the statement that PCB's were not detected.

P7.9 ¶ 1: Since vapor pressure is a characteristic constant and rate of volatilization is a kinetic phenomenon, it is probably not appropriate to equate the two. (At equilibrium, the rate of volatilization will be zero regardless of the characteristic vapor pressure).

P7.9 ¶ 3: The statements on Koc vs mobility reflect a poor understanding of environmental behavior. Koc describes the ability of a substance to partition itself between organic matter and water. Material sorbed to organics can still be mobilized through the hydrosphere - either as soluble organic complexes or by bed-load transport.

P2.7 ¶ 5: Half life is not restricted to "pure" chemicals or to loss only by the mechanism of vaporization.

P7.10 ¶ 5: If carbon disulfide was infrequently detected (once), why wasn't it discarded earlier with acetone and other contaminants?

P7.12 ¶ 2: While these statements are justified based on existing off-site conditions. The logic would seem to be flawed because they fail to consider future off-site transport of site contaminants via the groundwater mechanism.

P7.12 ¶ 3: Have acetone and methylene chloride been determined to be laboratory contaminants or assumed? I don't believe the level of writing in the report justifies use of the term "determined".

P7.12 ¶ 1: Same comment on use of Term "determined". Judged might be more appropriate than determined.

P7.14 ¶ 1: The argument for lack of bioaccumulation is weak. Contaminants below the analytical limit of detection could still be potentially bioaccumulated by aquatic organisms.

P7.16 ¶ 2: There should be a statement as to the meaning and/or significance of the information in Table 7-14 and Table 7-15.

P7.17 ¶ 5: It seems illogical to assume children 1 to 6 years will be playing in sediment daily. In the yard, in soil perhaps; but who lets a 1 year old play in sediment daily?

P7.19 ¶ 3: According to the reference title, The Bogen et. al., model is only for TCE. How appropriate is it for other site indicators?

P7.20 ¶ 6: Statement on teratogenic activity should be referenced.

P7.21 ¶ 2: What is a very low incremental increase in risk?

P7.21 ¶ 3: What are low probability and low order?

P8.3 ¶ 3: A pH of 3.7 is natural?
A pH range of 3.7 to 12.3 isn't normal.

P8.3 ¶ 3: Several metals exceed water quality criterion - yet these levels are not considered significant?

PH.1: At a minimum, there is nothing in this section to support the statement that there was any active control of accuracy in the data generation process. If the laboratory does it through CLP, project management has no control. How do the two laboratories compare? What were the project DQO's?

PH-3: What was the basis for "judging" the data sets to be valid and complete?

D&M-11(D)
D&M-10(B)
D&M-09(D)
D&M-08(B)
D&M-04(S)
D&M-13(B)
D&M-12(B)
D&M-07(B)
D&M-06(D)
D&M-02(S)
D&M-05(B)
D&M-03(S)
SMW 22
SMW 12
SMW 18
SMW 24
SMW 06
SMW 01
SMW 02
SMW 10
DMW 02
DMW 03
CSW-07
CSW-06
Rd-5
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ORIGINAL
(Red)

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